

received and most noted speeches in favor of the gold standard. His last ten years he spent in Paris, having been elected director of the International Bureau of Weights and Measures, located at Sevres. The physical data compiled by him for the first volume of the annals of that bureau were adopted as the basis of the international meteorological tables.

C. A. Bjerknes (1825-1903), professor of applied mathematics in the University of Christiania, was a contemporary and a collaborator of O. J. Broch, and his name must be mentioned whenever the history of natural science shall be written. His researches in the realm of magnetism and electricity attracted wide attention in the seventies and eighties. He wrote a very well received biography of Nils Henrik Abel, of whom he was a great admirer, having been active in calling the attention of his countrymen to the importance of the works of this profound genius. The results of his hydrodynamic researches are known as the C. A. Bjerknes Theory. His biography as published lately is a wonderful tale of struggle against disease and blindness.

Cato Maximilian Guldberg (1835-1902), Bjerknes' successor as professor of applied mathematics, was a versatile scientist. He is equally well known in the realms of astronomy, physics, and chemistry. In conjunction with his contemporary, Professor Waage, who conducted the chemical experiments, he applied the principles of mechanics to the phenomena of molecular attraction, supposed to exist between the smallest particles of matter, thereby practically raising the theory of chemical affinity and the science of chemistry from an experimental to an exact deductive stage. The results of his researches were first published in 1869 (*"Études sur les affinités chimiques"*), and his theory is known as the Guldberg-Waage-Law theory. Guldberg's style in his writings was brief and to the point. Together with Prof. Henrik Mohn, of Christiania, he published *"Hvirvel Centrernes Theori (Études sur les mouvements de l'atmosphère)"*, a very important work on the fundamental principles of meteorology.

Axel Sofus Guldberg, a younger brother of the above, is the author of the text-book in astronomy now used in the University of Christiania. The spirit of the Norwegian astronomer is shown by the following quotation from the Bible: "Canst thou bind the sweet influences of the Pleiades or loose the bands of Orion?" (Job xxxviii, 31.)

Wilhelm Friman Koren Bjerknes, born 1862, son of Prof. C. A. Bjerknes, when a young student took deep interest in his father's hydrodynamic researches. He was a pupil of Poincaré at Paris, and Hertz at Bonn, and was very active in the work connected with the so-called Hertzian waves, succeeding in explaining some points in their theory that had till then been misunderstood. He took his doctor's degree in 1892 and has since 1895 been professor in the school for mechanics and physics of the Stockholm University. He has published *"Vorlesungen über hydrodynamische Fernkräfte nach C. A. Bjerknes' Theorie."* He is considered the highest living authority in the study of the mechanics of fluids.

Kristian Birkeland, born 1867, and professor of physics in the University of Christiania, has attracted attention by his researches on the origin of the northern light (aurora borealis). His *"Recherches sur les taches du soleil et leur origine"* sets forth his whole theory. He has made some important practical inventions. His invention of a method of utilizing atmospheric electricity for fertilizing purposes has been taken up by a stock company that has made some very successful experiments.

It was quite natural that a country with such an extended coast line, where the inhabitants mainly follow the sea for a living, should early awaken to the vital importance of meteorology to the safety of life. The Meteorological Institute at

Christiania was established by Prof. Henrik Mohn, who still remains the head of that institution, where he has achieved many a meteorological triumph and has been the means of saving thousands of lives and millions in property. Before the establishment of the institution, about 1867, it was an almost yearly occurrence to have hundreds of fishermen and their boats destroyed by storms that even the experienced eye of the fisherman could not discover beforehand. Now such sad disasters are rarely heard of. To the Norwegian fisherman the Meteorological Institute is no joke; it is the one government institution he can endorse and feel grateful for.

Prof. Henrik Mohn, the first professor of meteorology in the University of Christiania and director of the Meteorological Institute, was born in 1835. He was the leader of the Norwegian Arctic Expedition, 1882-1883, the results of which were published in 1887. To him belongs the credit for having established meteorological stations as far north as possible, thereby contributing considerably to our meteorological knowledge of the globe. He also established a meteorological service for the Arctic Ocean, having secured the services of the captains of the Norwegian fishing vessels as voluntary observers. His treatise *"Grundzüge der Meteorologie"* (9th Ed. Berlin, 1883) has been translated into most modern languages and is considered a handbook of great value. Other publications by him are: *"Temperature de la mer entre l'Irland, l'Ecosse et la Norvege,"* (Christiania 1870), *"Oversigt over Norges Klimatologi"* (Christiania 1870), and, together with Professor Guldberg, *"Hvirvel Centrernes Theori,"* or *"Études sur les mouvements de l'atmosphère."* He has also just now edited the volume of meteorological results of Professor Nansen's Arctic Expedition.

A VISIT TO EUROPEAN OBSERVATORIES.

By GERALD J. O'CONNOR. Dated St. Louis, Mo., October 5-November 25, 1905.

A few observations made in the months of July and August, 1905, while touring in foreign lands, may be worthy of publication in the MONTHLY WEATHER REVIEW.

The itinerary included France, Italy, Switzerland, western Germany, Belgium, England, and Ireland.

While in London the opportunity was afforded me of visiting the Royal Observatory at Greenwich, from whose meridian longitudes are counted by nearly all nations. This observatory stands on an eminence about five miles southeast of London Bridge. A castle had been erected on this site in the reign of Henry V. During succeeding reigns it was occupied as a residence by members of the royal family, and in Queen Elizabeth's time it was used as a prison. In the reign of Charles II it was converted to its present use as an observatory, Sir Christopher Wren making the necessary alterations in 1675. The post of astronomer royal has been successively held by John Flamsteed, 1675-1719; Doctor Halley, 1720-1742; Doctor Bradley, 1742-1762; Nathaniel Bliss, 1762-1764; Doctor Maskelyne, 1765-1811; John Pond, 1811-1835; Sir George B. Airy, 1835 to 1881, when the present astronomer royal, Sir W. H. M. Christie, was appointed.

It was during the administration of Sir George B. Airy that the work was made to include meteorological observations and instruments for continuously recording atmospheric phenomena. Among instruments not ordinarily found at Weather Bureau stations in the United States is one for registering the pressure of the wind on a surface.

The central office for the collection and dissemination of weather information in France is at No. 176 Rue de l'Université, in Paris. Observations of temperature, precipitation, and wind direction and velocity are taken at a convenient time between 7 and 8 a. m., at fifteen stations within the city limits. One of these local observatories is at the summit of the Eiffel Tower; another in the tower of St. Jacques. I visited both of these. At the latter a daily map and forecast of "proba-

bilities" is issued. The map shows the weather conditions over France as determined from 25 stations, well distributed throughout the Republic. By means of a telegraphic cipher code, reports are received from stations at the capitals of almost all European nations, thus forming a network that sparsely covers the Continent.

At Rome there are at present four well-known observatories.

1. The weather service of Italy is a part of the Ufficio or Bureau of Meteorology and Geodynamics; its first chief, Professor Tacchini, recently died. Both meteorological and astronomical work are done at its station in the Collegio Romano, in Rome. I visited this observatory on July 11, having the honor to be presented by letter from the American Consul-General at Rome, Mr. Hector de Castro. Meteorological observations are here taken systematically and interchanged by telegraph daily with the capital cities and other important places in Europe. The instruments in use and the records of observations are essentially the same as those of the United States Weather Bureau. This observatory of the Collegio Romano was founded in 1550 by Julius III and rebuilt in 1582 by Gregory XIII (1572-1585) as a part of the famous Jesuit college. DeVico became director in 1838 and began effective astronomical work. It was rebuilt in 1853 under Secchi's directorate and devoted equally to meteorology and astronomy. It was while pursuing his labors here that the learned Jesuit Father Secchi became famous as a most zealous student of spectrum analysis, the branch of chemistry that reveals the constituent elements of the stars. His division of the stars into four types, according to variety and strength of the colored lines in their spectra, is but one of many works that will ever associate his name with astronomy. When the Jesuits were removed from this building in 1870, they established their college near by in the Borromeo Palace under a new name as the Pontifical Gregorian University; but Father Secchi, who had been in charge of the observatory since 1850, was allowed to remain in the Collegio Romano. After Secchi's death, in 1878, Millosevich was called from the Nautical Institute of Venice to take up the work at this observatory as a branch of the Central Office of Meteorology and Geodynamics. Thus, while retaining its old name, this observatory now belongs to the Government of Italy. Its latitude and longitude are $41^{\circ} 53' 53.6''$ north, $0^{\circ} 49' 55.55''$ east from Greenwich.

2. The Observatory (established in 1827) of the Royal University (which was founded in 1303), located on the Campidoglio, and sometimes known as the Royal Observatory, or the Observatory of the Capitol. Here the astronomer Respighi made his observations of the solar spots. At present Prof. A. DiLegge is director and conducts both astronomical and meteorological work. Its latitude and longitude are $41^{\circ} 53' 33.5''$ and $0^{\circ} 49' 56.37''$.

3. There is an observatory on the Janiculum, but its exact latitude and longitude I do not know. It is the personal property of Rev. A. Mueller, S. J., who is a professor in the Gregorian University. Only astronomical work is done here.

4. On July 13 I had the honor of visiting another famous observatory in Rome, that of the Vatican. For this rare privilege I was indebted to Monsignor Kennedy, Rector of the American Catholic College in Rome, and to Monsignor Uglione, Prefect of the Propaganda. After four days spent in viewing works of art, as displayed in the architecture, sculpture, and paintings in the various churches in the eternal city, it was indeed gratifying to me to gain admittance to a branch of the Vatican Palace that is devoted to the advancement of science. This observatory was founded in 1580 by Gregory XIII for astronomical work; in 1800 meteorological work was added. The late Pope Leo XIII labored incessantly after his accession in 1878 to establish an alliance between science and faith, believing there can be nothing fundamental in faith that is not consonant with demonstrated truth. He was installed in the chair

of St. Peter at the time when the Rev. Father Peter Angelo Secchi had spread luster about the observatory of the Collegio Romano; this inspired an effort on Leo's part to modernize the analogous institution within the Vatican grounds by equipping certain apartments with the latest approved instruments for meteorological, astronomical, magnetic, and seismological work. The reorganized observatory began its work under the direction of Rev. F. Denza, and the first volume of the new series of observations was published in 1891. Denza died suddenly December 14, 1894, and his successor, Rev. Angelo Rodriguez y Prada, is now director.

This observatory, the Specola Vaticana as it is called in Italian, is located in the upper part of a building in the Vatican which in honor of its founder and to distinguish it from the building occupied by the Gregorian University, it is known as the Gregorian tower. It is a massive structure, rising considerably above most of the buildings that comprise the Vatican Palace, and containing many spacious apartments well adapted to meteorological and astronomical work. It was in one of these rooms (beautifully frescoed by the greatest artists of the time) that the commission, appointed by Pope Gregory XIII in 1582, reformed the calendar and made it obligatory throughout the Catholic world. During the three hundred years which have elapsed since that date the observatory has undergone numerous vicissitudes. Work in the astronomical department, which had been commenced so auspiciously and from which so much was expected, was gradually discontinued and all regular observations abandoned. Many efforts were made at various times to revive the institution, but it was not until the year 1887 that rehabilitation was undertaken. Father Denza, who had gained distinction as astronomer and philosopher, was placed in charge. Being of an inventive turn of mind he repaired and improved such of the instruments as had been neglected, and caused many new instruments to be installed. In 1888, on the occasion of the fiftieth anniversary of his elevation to the priesthood, Pope Leo perfected its entire rejuvenation; and in order that it might not again be exposed to the vicissitudes which had marked its previous history, his holiness endowed it with a sum ample to meet all current expenses. In a short time not only was the building renovated, but new instruments were installed and everything put in readiness for systematic and continuous observations. Two spacious rooms were reserved for meteorological instruments. In addition to the barometers, thermometers, anemometers, sunshine recorders, pluviographs, barographs, and thermographs, and such other instruments as are in use at Weather Bureau stations, there is also a self-recording psychrometer in design similar to the thermograph but having both wet and dry-bulb attachments. A wick connects the wet bulb with a vessel containing water on top of the cover of the instrument. A large heliograph and its appurtenances, used in photographing the sun, occupies the uppermost suite of rooms in the Gregorian tower. In addition to the rooms reserved in the tower for meteorological observations, certain portions of the Vatican gardens are set aside for experiments in terrestrial magnetism.

Another important addition to this observatory is a large photographic equatorial, in size and design like the great instrument in the National Observatory at Paris. This is located in the Leonine tower, about a quarter of a mile distant on the summit of the Vatican hill. Its internal diameter is about sixty feet and the walls at the base are not less than fifteen feet in thickness. The auxiliary apparatus used in connection with the equatorial is open to inspection as are also a number of other instruments including the seismograph. The structure is well adapted for the purposes of an observatory, being remarkably free from vibration and possessing a clear horizon. Both the Gregorian and the Leonine towers are now included in what is known as the Vatican Observatory.

In 1888 the astronomers of the Old World resolved to make a photographic map of the entire celestial sphere. Two series of observations were taken, one being a photographic reproduction of the starry vault, the other a new catalogue of position of stars greater than those of the twelfth magnitude. Father Denza took a great deal of interest in this work. Like his illustrious friend, Father Secchi, he was an ardent lover of nature and possessed a natural aptitude for the study of astronomy, meteorology, and the natural sciences. He was the founder of the Italian Meteorological Society and for more than a quarter of a century its director-general. Up to the time of his death in 1894, he contributed frequently to the meteorological journals of Europe.

The scientist who now presides is Rev. Angelo Rodriguez; he has a staff of seven assistants. The latitude and longitude of the Specola Vaticana are $41^{\circ} 54' 4.8''$ north, and $0^{\circ} 49' 47''$ east, as given in the American Ephemeris and Nautical Almanac; the last volume of the annals of the observatory on the Leonine tower gives the same longitude, but gives the latitude as $41^{\circ} 54' 16.7''$.

The advantages of a great continental weather service, as reflected in the unqualified success of the United States Weather Bureau, have begun to be appreciated by all Europeans. It may be attributed to this that Professor Rodriguez is devoting more time than either of his distinguished predecessors to the meteorological department of the observatory; notwithstanding this he or one of his assistants is constantly at work with the great equatorial. In consequence of the existing relations between the Vatican and the Government of Italy, the observations and publications of the Vatican Observatory have no connection with the general meteorological service of Europe.

I can not conclude these remarks without special reference to the kindness of Professor Rodriguez. Although he could not speak English any better than I could speak Italian, yet, by reason of a certain familiarity with the subject, we managed to carry on an interesting conversation. He is a skilful observer and well versed in the principles of meteorology. To Professor Rodriguez I expressed the hope that I might find an opportunity to write a few lines appreciative of the Specola Vaticana. "Va bene" (go well) said he, and other words, which I interpreted to mean that he would be glad to know that the observatory of which he is director compares favorably with others I had seen in the Old World and the New.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

H. H. KIMBALL, Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

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- Bartholomew, J. G. (Ed.)**
The survey gazetteer of the British Isles . . . 928 pp. 4°. London. 1904.
- Batavia.** K. Magnetisch en Meteorologisch Observatorium.
Regenwaarnemingen in Nederlandsch Indie. v. 26, 1904. vii, 469 pp. 4°. Batavia. 1905.
- Bloxam, Charles Loudon.**
Chemistry inorganic and organic, with experiments. 9th edition, revised by J. M. Thomson and A. G. Bloxam. xi, 872 pp. 8°. London. 1903.
- Börnstein, R[ichard].**
Unterhaltungen über das Wetter. 48 pp. 12°. Berlin. 1905.
- Canada. Meteorological Service.**
Report of the Meteorological Service of Canada for the year ended Dec. 31, 1903. xix, 384 pp. 4°. Ottawa. 1904.

Chambers, George F[rederick].

A handbook of descriptive and practical astronomy. 4th edition. 3 v. 8°. Oxford. 1889-1890.

Cowling, James.

Weather instruments for the home. 2d edition. 62 pp. 16°. New Jersey. 1904.

Fitzner, Rudolf.

Beiträge zur Klimakunde des Osmanischen Reiches und seiner Nachbargebiete. Part 1. Meteorologische Beobachtungen in Kleinasien 1902. 36 pp. 4°. Berlin. 1904.

Die Fortschritte der Physik. I, II, 1904. 8°. Braunschweig. 1904.

Geographisches Jahrbuch. 1905. 8°. Gotha. 1905.

Hann, Julius.
Lehrbuch der Meteorologie. 2d revised edition. xi, 642 pp. 4°. Leipzig. 1906.

Hedges, Killingworth.

Modern lightning conductors: an illustrated supplement to the report of the Lightning Research Committee of 1895 . . . vi, 119 pp. 4°. London. 1905.

International Geographic Congress, Washington, 1904.

Report. (58th Congress, 3d session, House doc. 460), 1064 pp. 8°. Washington. 1905.

Interstate Astronomical and Meteorological Conference, Adelaide, 1905.

Report. 11 pp. f°. Adelaide. 1905.

Kharkof. University. Meteorological Observatory.

Résultats des observations faites au nouvel observatoire météorologique de l'université de Kharkow. 1901. [Russian and French text.] iv, 131 pp. 8°. Kharkof. 1904.

Linke, F[rantz].

Luftelektrische Messungen bei zwölf Ballonfahrten. (Abhandlungen der königlichen Gesellschaft der Wissenschaften zu Göttingen. Math.-phys. Klasse. Neue Folge. Band III. No. 5.) 90 pp. 4 tables. 4°. Berlin. 1904.

Liznar, J[oseph].

Die barometrische Höhenmessung. 48 pp. 4°. Leipzig. 1904.

Marriott, William.

Hints to meteorological observers. Prepared under the direction of the council of the Royal Meteorological Society. 6th edition. 69 pp. 8°. London. 1906.

Mascart, E.

Traité de magnétisme. vi, 441 pp. 4°. Paris. 1900.

Miller, N. H. J.

Amounts of nitrogen as ammonia and as nitric acid and of chlorine in the rainwater collected at Rothamsted. (From the Journal of Agricultural Science. v. 1, pt. 3, Oct., 1905.) pp. 280-303. 8°. Cambridge (Eng.) [1905.]

Mysore. Meteorological Department.

Meteorology in Mysore for 1904 being the results of observations at Bangalore, Mysore, Hassan, and Chitaldrug. xv, 56 pp. 4°. Bangalore. 1905.

Schubert, J[ohannes].

Wald und Niederschlag in Schlesien. (Reprinted fr. Zeitschrift für Forst- und Jagdwesen. v. 37, pp. 375-380, June, 1905.) 8°. Berlin. 1905.

Soddy, Fredk.

Radio-activity: an elementary treatise from the standpoint of the disintegration theory. xi, 214 pp. 8°. London. 1904.

Sutton, J. R.

On the variation of the hourly meteorological normals at Kimberley during the passage of a barometric depression. (From the Transactions of the South African philosophical society. v. 16, pt. 2.) pp. 169-188. 4°.

Sutton, J. R.

Some results of observations made with a black bulb thermometer in vacuo. (From the Transactions of the South African philosophical society. v. 16, pt. 2.) pp. 79-96. 4°.

Tacubaya. Observatorio Astronomico Nacional de Tacubaya.

Anuario. 1906. 494 pp. 16°. Mexico. 1905.

Thévenet, [Antoine Francois].

Recherches sur la prévision du temps en Algérie. 71 pp. 8°. Alger. 1905.

Wade, E. B. H.

Report on the use of platinum resistance thermometers in determining the temperature of the air at Helwan Observatory. 24 pp. 4°. Cairo. 1905.

Voeikov, A[leksandr] I[vanovich].

Meteorology. [Russian text.] In 4 parts. XVII, 737, VII pp. 8°. St. Petersburg. 1903-04.

RECENT PAPERS BEARING ON METEOROLOGY.

H. H. KIMBALL, Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or